

## CLAIMS

1. In a digital filter for sub-band synthesis, a method of performing an IDCT (Inverse Discrete Cosine Transform) process that generates time domain samples from frequency domain samples using prestored cosine coefficients, comprising:

    prestoring only the cosine coefficients that satisfy  $\cos (\pi * (i/64))$  for  $i = 0$  to 32; and

    calculating cosine coefficients for  $i = 33$  to 63 using the prestored coefficients by changing a sign of a corresponding symmetrical one of the stored coefficients, respectively.

2. The method of claim 1, further comprising the step of:

    generating sixty-four time domain samples ( $V_i$ ) from thirty-two frequency domain samples ( $S_k$ ) according to the equation

$$V_i = \sum_{k=0}^{31} \cos ((\pi/64)(i+16)(2k+1)) \times S_k$$

for  $i = 0$  to 63, using only the prestored cosine coefficients and the calculated cosine coefficients.

3. The method of claim 2, wherein the sequence of time domain samples are from an MPEG compliant audio sub-band.

4. In a digital filter for sub-band synthesis, a method of performing an IDCT (Inverse Discrete Cosine Transform) process that generates time domain samples from frequency

domain samples using prestored cosine coefficients,  
comprising:

    prestoring only the cosine coefficients that satisfy  
cos ( $\pi * (i/64)$ ) for  $i = 0$  to 63.

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5. The method of claim 4, further comprising the step  
of:

    generating sixty-four time domain samples ( $V_i$ ) from  
thirty-two frequency domain samples ( $S_k$ ) according to the  
10 equation

$$V_i = \sum_{k=0}^{31} \cos ((\pi/64) (i+16) (2k+1)) \times S_k$$

for  $i = 0$  to 63, using the prestored cosine coefficients.

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6. The method of claim 5, wherein the sequence of time  
domain samples is from an MPEG compliant audio sub-band.

7. In a digital filter for sub-band synthesis, a method  
20 of performing an IDCT (Inverse Discrete Cosine Transform)  
process that generates time domain samples from frequency  
domain samples using prestored cosine coefficients,  
comprising:

    prestoring only the cosine coefficients that satisfy  
25 cos ( $\pi * (i/64)$ ) where  $i = 0-32$ ;

    calculating the cosine coefficients for  $i = 33-63$   
using the stored coefficients by changing a sign of a  
corresponding symmetrical one of the stored coefficients,  
respectively; and

30      generating sixty-four samples ( $V_i$ ) from thirty-two sub-  
band samples ( $S_k$ ) according to the equation,

$$V_i = \sum_{k=0}^{31} \cos((\pi/64)(i+16)(2k+1)) \times S_k$$

for  $i = 0$  to  $63$ , using the prestored cosine coefficients and  
 5 the calculated cosine coefficients.

8. The method of claim 7, wherein the sequence of time domain samples is from an MPEG compliant audio sub-band.

10 9. In a digital filter for sub-band synthesis, a method of performing an IDCT (Inverse Discrete Cosine Transform) process that generates time domain samples ( $V_i$ ) from frequency domain samples ( $S_k$ ) using prestored cosine coefficients, where  $i$  and  $k$  are integer values defining columns and rows  
 15 respectively of a matrix of cosine coefficients, the method comprising:

    prestoring the cosine coefficients  $C(k-1, i)$  and  $C(k-2, i)$  for each column of the matrix;

    prestoring an adjustment value  $\cos(E(i))$  for each column  
 20 of the matrix; and

    calculating the cosine coefficients for the remaining locations in the matrix using the prestored coefficients and the prestored adjustment values in accordance with the equation

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$$C(k, i) = 2 \cos(E(i)) * C(k-1, i) - C(k-2, i).$$

10. The method of claim 9, wherein the adjustment value  $\cos(E(i))$  is calculated as  $\cos(\pi/64 * (i+16) * 2)$ .

30 11. The method of claim 9, wherein the adjustment value  $\cos(E(i))$  is calculated as  $\cos(\pi/72 * (2i+19) * 2)$ .

12. The method of claim 9, wherein the adjustment value  $\cos(E(i))$  is calculated as  $\cos(\pi/24 * (2i+7) * 2)$ .

13. The method of claim 9, further comprising the step  
5 of:

generating sixty-four time domain samples ( $V_i$ ) from  
thirty-two frequency domain samples ( $S_k$ ) according to the  
equation,

$$10 \quad V_i = \sum_{k=0}^{31} \cos((\pi/64)(i+16)(2k+1)) \times S_k$$

for  $i = 0$  to 63, using the prestored cosine coefficients and  
the calculated cosine coefficients.

14. The method of claim 13, wherein 128 coefficients are  
15 prestored and 64 adjustment values are prestored.

15. The method of claim 13, wherein the time domain  
samples is from an MPEG compliant audio sub-band.

20 16. In a digital filter for sub-band synthesis, a method  
of performing an IDCT (Inverse Discrete Cosine Transform)  
process that generates time domain samples ( $V_i$ ) from frequency  
domain samples ( $S_k$ ) using prestored cosine coefficients, where  
25  $i$  and  $k$  are integer values defining columns and rows  
respectively of a matrix of cosine coefficients, comprising  
the steps of:

prestoring the cosine coefficients  $C(k, i)$  and  $C(k-1, i)$   
for each column of the matrix;  
30 prestoring an adjustment value  $\cos(E(i))$  for each column  
of the matrix; and

calculating the cosine coefficients for the remaining rows and columns of the matrix using the prestored coefficients and the prestored adjustment values in accordance with the equation,

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$$C(k+1,i) = 2 \cos (E(i)) * C(k,i) - C(k-1,i).$$

17. The method of claim 16, further comprising the step of:

generating sixty-four samples ( $V_i$ ) from thirty-two sub-  
10 band samples ( $S_k$ ) according to the equation,

$$V_i = \sum_{k=0}^{31} \cos ((\pi/64)(i+16)(2k+1)) \times S_k$$

for  $i = 0$  to 63 using the prestored cosine coefficients  $C(k,i)$   
15 and  $C(k-1,i)$  and the cosine coefficients calculated using the adjustment value.

18. The method of claim 17, wherein the cosine coefficients for the next iterations are precalculated using  
20 the adjustment value in parallel with the calculation of the samples ( $V_i$ ).

19. The method of claim 17, wherein a first group of the cosine coefficients and a second group of the cosine  
25 coefficients are calculated in parallel using separate processors.

20. The method of claim 19, wherein the first group of cosine coefficients is  $\cos(k+2,i)$  for  $k=0, 2, 4, \dots 14$  and the  
30 second group of cosine coefficients is  $\cos(k+2,i)$  for  $k=1, 3, 5, \dots 15$ .

21. The method of claim 16, wherein the time domain samples is from an MPEG compliant audio sub-band.

22. The method of claim 16, wherein the number of  
5    prestored cosine coefficients is reduced by prestoring only  
two columns of the cosine coefficients and one column of the  
adjustment values  $\cos(E)$  such that the size of the prestored  
matrix is  $3 \times 3$  and the remaining cosine coefficients are  
calculated.

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23. The method of claim 22, further comprising the step  
of:

generating sixty-four samples ( $V_i$ ) from thirty-two sub-  
band samples ( $S_k$ ) according to the equation,

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$$V_i = \sum_{k=0}^{31} \cos((\pi/64)(i+16)(2k+1)) \times S_k$$

for  $i = 0$  to 63 using the prestored cosine coefficients and  
the calculated cosine coefficients.

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24. A digital filter for sub-band synthesis, comprising:  
a memory for prestoring only the cosine coefficients that  
satisfy  $\cos(\pi * (i/64))$  for  $i = 0$  to 32; and

a processor, connected to the memory for receiving the  
25    prestored cosine coefficients, for performing an IDCT (Inverse  
Discrete Cosine Transform) process that generates time domain  
samples from frequency domain samples using the prestored  
cosine coefficients, wherein the processor calculates  
calculating cosine coefficients for  $i = 33$  to 63  
30    using the prestored coefficients by changing a sign of a  
corresponding symmetrical one of the prestored coefficients,  
respectively.

25. The digital filter of claim 24, further comprising:  
means for generating sixty-four time domain samples ( $V_i$ )  
from thirty-two frequency domain samples ( $S_k$ ) according to the  
equation

$$V_i = \sum_{k=0}^{31} \cos ((\pi/64)(i+16)(2k+1)) \times S_k$$

for  $i = 0$  to 63, using only the prestored cosine coefficients  
and the calculated cosine coefficients.

26. A digital filter for sub-band synthesis, comprising:  
a memory for prestoring only the cosine coefficients that  
satisfy  $\cos (\pi * (i/64))$  for  $i = 0$  to 63; and

a processor, connected to the memory and receiving the  
prestored cosine coefficients, for performing an IDCT (Inverse  
Discrete Cosine Transform) process that generates time domain  
samples from frequency domain samples using the prestored  
cosine coefficients, wherein the processor generates sixty-  
four time domain samples ( $V_i$ ) from thirty-two frequency domain  
samples ( $S_k$ ) according to the equation

$$V_i = \sum_{k=0}^{31} \cos ((\pi/64)(i+16)(2k+1)) \times S_k$$

for  $i = 0$  to 63, using only the prestored cosine coefficients.

27. A digital filter for sub-band synthesis via an IDCT  
process that generates time domain samples ( $V_i$ ) from frequency  
domain samples ( $S_k$ ), where  $i$  and  $k$  are integer values defining  
columns and rows respectively of a matrix of cosine  
coefficients, the digital filter comprising:

a memory for prestoring the cosine coefficients  $C(k-1,i)$  and  $C(k-2,i)$  for each column of the matrix and an adjustment value  $\cos(E)$  for each column of the matrix; and

5 a processor for calculating the cosine coefficients for the remaining locations in the matrix using the prestored coefficients and the prestored adjustment values in accordance with the equation

$$C(k,i) = 2 \cos (E(i)) * C(k-1,i) - C(k-2,i).$$

10 28. A digital filter for sub-band synthesis via an IDCT process that generates time domain samples ( $V_i$ ) from frequency domain samples ( $S_k$ ), where  $i$  and  $k$  are integer values defining columns and rows respectively of a matrix of cosine coefficients, the digital filter comprising:

15 a memory for prestoring the cosine coefficients  $C(k)$  and  $C(k-1,i)$  for each column of the matrix and an adjustment value  $\cos(E(i))$  for column of the matrix; and

a processor for calculating the cosine coefficients for the remaining rows and columns of the matrix using the  
20 prestored coefficients and the prestored adjustment values in accordance with the equation,

$$C(k+1,i) = 2 \cos (E(i)) * C(k,i) - C(k-1,i).$$